TEMPLATE FOR COURSE SPECIFICATION

HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAMME REVIEW

COURSE SPECIFICATION

In the real life problems, mathematical equations which describe behavior of many physical systems cannot be solved analytically, therefore, numerical methods are often used. This course introduces variety of numerical methods and algorithms. This course introduces students to: Error analysis; Finding roots of a non-linear function; Approximation and interpolation; Numerical integration and differentiation.

1. Teaching Institution	Al-Nahrain University/ College of Science
2. University Department/Centre	College of Science, Department of Mathematics and Computer Applications
3. Course title/code	Numerical Analysis I, MATH314
4. Modes of Attendance offered	Full time attendance
5. Semester/Year	1st / 2022/2023
6. Number of hours tuition (total)	45 hours of Lectures (3 hours weekly) + 15 hours of tutorials 1 hour weekly +30 hours of lab (2 hours weekly)
7. Date of production/revision of this specification	12th Oct 2022
8. Aims of the Course	
This course is an introduction to the numerical analysis. The primary objective of the course is to develop the basic understanding of numerical algorithms and skills to implement algorithms to solve mathematical problems on the computer.	

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9· Learning Outcomes, Teaching ,Learning and Assessment Methode

A- Cognitive goals .

A1) Understand the numerical solution of nonlinear equations.
A2) Understand the numerical solution of simultaneous linear algebraic equations.
A3) Understand the basic of finite difference methods and interpolation.
A4) Understand the numerical differentiation and integration

B. The skills goals special to the course.

B1. Implement numerical methods illustrated using Matlab.
B2. Analyze the numerical error and convergence.
B3. Determine whether the numerical solution(s) are stable or not.

Teaching and Learning Methods

Lectures: 3 hours lectures per week will be given to students.
Tutorials: one hour per week.
Laboratories: Two hours per week.
Assignments: One assignment will be given by the end of each lecture.

Assessment methods

Midterm exams, Final exam, Quizzes, Weekly homework, weekly Laboratory exam.

C. Affective and value goals

An ability to create, select, apply, adapt, and extend appropriate techniques, resources, tools to a range of mathematical an physical problems, from simple to complex, with an understanding of the associated limitations.

D. General and rehabilitative transferred skills(other skills relevant to employability and personal development)

Dl) Discuss and work in a group in order to solve numerical approximation problems.

D2) Discuss and work in a group in order to program numerical solutions using Matlab.

D3) Demonstrate developed solutions and programs.

10. Course Structure

Week	Hours	ILOs	Unit/Module or Topic Title	Teaching Method	Assessment Method
1	3 hrs of lecture +1 hr tutorial+2 hours of lab	Preliminaries of Computing	Fundamentals of MATLAB Programming, Numerical Solution, type of errors; relative error, absolute error, percentage error, truncation error, round off error. Floating	Lectures , Example Classes , Practical Applications, Tutorial	Exams , Weekly homework, Team and homework problems , Open questions that have a definite answer , (Oral questions)
2	3 hrs of lecture +1 hr tutorial+2 hours of lab	Numerical solution of Nonlinear Equations	Bisection method, fixed-point iteration, Newton's method.		
3	3 hrs of lecture +1 hr tutorial+2 hours of lab		Error analysis for Iterative Methods		
4	3 hrs of lecture +1 hr tutorial+2 hours of lab		Computing roots of polynomials.		
5	3 hrs of lecture +1 hr tutorial+2 hours of lab	Interpolation and Polynomial Approximation	Lagrange Polynomial		
6	3 hrs of lecture +1 hr tutorial+2 hours of lab	Midterm exam			
7	3 hrs of lecture +1 hr tutorial+2 hours of lab	Interpolation and Polynomial Approximation	Divided Differences		
8	3 hrs of lecture +1 hr		Hermite Interpolation, Extrapolation Methods		

	tutorial+2 hours of lab				
9	3 hrs of lecture +1 hr tutorial+2 hours of lab	Numerical Differentiation	Forward, backward and central difference approximation of the derivatives.		
10	3 hrs of lecture +1 hr tutorial+2 hours of lab	Midterm exam			
11	3 hrs of lecture +1 hr tutorial+2 hours of lab	Numerical Differentiation	Higher Order Derivatives.		
12	3 hrs of lecture +1 hr tutorial+2 hours of lab	Numerical Integration	Trapezoidal Method, Simpson's Method		
13	3 hrs of lecture +1 hr tutorial+2 hours of lab		Quadrature Integration Methods, Including Gauss-Quadrature Methods, NewtonCots Open and Closed Methods		
14	3 hrs of lecture +1 hr tutorial+2 hours of lab		Romberg integration		
15	6hrs	Review			

11. Infrastructure	
1. Books Required reading:	Burden, R. L., Faires, J. D., & Burden, A. M. (2015). Numerical analysis. Cengage learning.
2. Main references (sources)	[1] J. Stoer and R. Bulirsch, Introduction to Numerical Analysis, Springer-Verlag, ISBN 0-387- 90420-4 [2] C.T. Kelley, Iterative methods for linear and nonlinear equations, Society of Industrial and Applied Mathematics
A- Recommended books and references (scientific journals, reports…).	

B-Electronic references, Internet sites…	

12. The development of the curriculum plan